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COMANDRA RUST DAMAGE TO PONDEROSA PINE IN OREGON AND WASHINGTON

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SUMMARY

The damaging rust, *Cronartium comandrae*, is common in many localities but is often overlooked or confused with other causes of damage. Cankers in lower crowns are immediate threats to young-mature trees, but rust-killed tops in old-growth timber are not necessarily indicative of high-risk trees. Damage in thinned stands can be reduced by careful selection of crop trees. This rust is of little importance in unthinned young stands.

INTRODUCTION

Comandra rust, caused by *Cronartium comandrae* Pk., is common and moderately damaging on ponderosa pine (*Pinus ponderosa* Laws.) in many localities in this region,¹ especially along the east side of the Cascade Range. Its effects are often overlooked because it is inconspicuous in small trees and its symptoms in large trees are confused with those of other causes of damage.

This rust, like many others, does not spread directly from tree to tree. Its alternate host here is *Comandra umbellata* (L.) Nutt. (fig. 1, A and B), a species of bastard toadflax which may fluctuate widely in local abundance within periods of a few years. Control by eradication of the alternate host is not practical.

Pine infections apparently originate mostly in "wave years," at intervals of perhaps 10 to 20 years, when conditions are unusually favorable for spread of the disease. Infections start on young shoots, probably through the needles, from which the fungus grows into and along the branches. Infected branches develop spindle-shaped, roughened swellings (fig. 1, C, D, and E) where infection entered; such branches are helpful in detection of the disease as long as they remain on the tree.

Although infected branches ordinarily survive for several years, the fungus does not grow rapidly, and cankers that start far from the trunk are eventually eliminated by branch death. Cankers starting near the trunk usually enter it, where they continue to grow in length until the tree is eventually killed.

Young cankers on pole-size and larger trunks often appear as oval gnawed areas centered at the branch where infection started (fig. 1, F and G). Irregularly gnawed areas are too common on uninfected trunks, especially on small ones, to be of much diagnostic value, but may attract attention to more reliable indicators (fig. 1E).

¹Western gall rust, caused by *Peridermium harknessii* Moore, is also common in some ponderosa pine stands but is easily recognized by the large, rounded swellings it causes on trunks and branches. For detailed descriptions of western gall rust and comandra rust, see:

Peterson, Roger S. Western gall rust on hard pines. U.S. Dep. Agr. Forest Pest Leaflet, 50, 8 pp., illus. 1960.

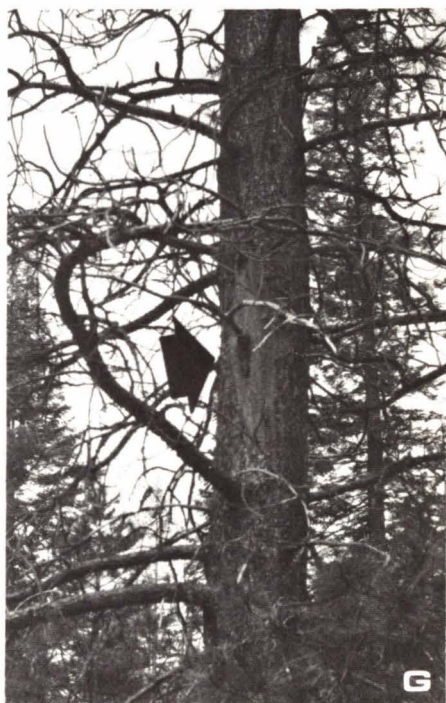
Mielke, James L. Comandra blister rust. U.S. Dep. Agr. Forest Pest Leaflet, 62, 7 pp., illus. 1961.

Mielke, J. L., and Krebill, R. G. Comandra blister rust of hard pines. 1968. (Revision of U.S. Dep. Agr. Forest Pest Leaflet, 62 in preparation for publication.)





Figure 1. A and B, Bastard toadflax, alternate host of comandra rust (pustules of uredospores are visible in B on bottoms of two leaves); C and D, cankers on sapling trunks (the branch through which the infection entered is at right center in each photograph); E, irregularly gnawed canker (infection entered through branch at left near canker center); F and G, trunk cankers with gnawed areas of characteristic oval shape.



EFFECTS

In sapling and small-pole stands.— Vigorous young trees, the potential crop trees, are infected more frequently than poor ones, and infected young trees are killed before they reach merchantable size. In unthinned stands this mortality may lengthen rotations slightly but is unimportant since it is scattered, seldom exceeds 5 percent of the stand, and results in understocking only if no surplus reproduction is present.

In thinned stands the disease may cause substantial damage, largely because it is so hard to detect in young trees. Pustules of the orange-red aeciospores are not common and, when present, usually are more or less concealed under bark scales. Telltale branch swellings disappear as the killed branches fall, infected trunks are seldom noticeably swollen or constricted, and bark roughening from infection is often indistinguishable from slightly abnormal roughening of healthy trunks. Consequently, thinning crews will miss many of the infected trees. Since the better trees are disproportionately heavily infected, thinning in diseased stands is likely to leave increased percentages of infected trees at the same time that it eliminates replacements for trees that will be killed.

Although pine thinnings are mostly recent and of relatively small extent, some stand-opening by comandra rust has already been observed in one thinned stand.

In mature stands.— Lower-crown infections sometimes reach the trunk in young-mature timber but rarely in old growth. Infections in upper trunks are practically invisible from the ground until crown symptoms appear. The first easily seen symptom is death of branches in a rather narrow zone around the trunk where infection entered (fig. 2A). Above this zone, the crown then becomes faded and thin (fig. 2B) and dies within a few years. Progress of the infection down the trunk is indicated, from time to time, by death of the uppermost branch or branches in the remaining crown (fig. 2C). Downward growth of the fungus continues until the entire tree is killed but is so slow that large trees usually survive for more than a century.

In a mature to old-mature stand, all pines 12 inches d.b.h. and larger on 6 acres² were examined with field glasses. In 117 trees not excessively complicated by other injuries, 23 dead tops were charged with reasonable certainty to comandra rust. After 5 years, all of these 23 trees were still alive, and additional dieback, as indicated by branches killed since the

²Plots on the Yakima-Indian Reservation in cooperation with Bureau of Indian Affairs, U.S. Dep. of the Interior.

first examination, could be detected in only five of them, over distances of 2, 3, 4, and 8 feet. The average rate of dieback thus determined for the 23 trees, about 2 inches per year, is obviously too low, but these data together with observations of weathering of killed tops and branches indicate that downward growth of cankers is less than 6 inches per year.

The slow, continuous downward progress of infection makes it easy, in most instances, to distinguish between tops killed by comandra rust and those killed by other agents such as drought, porcupines, and dwarf-mistletoe. Top-killing by such other agents is usually simultaneous over the entire length of the killed section and often followed by erection of a branch to form a new leader. Top-killing by the rust is simultaneous only above the level where the trunk was first girdled and never followed by development of a new leader. The infected portion of the trunk becomes so heavily pitch-soaked that it continues intact and sound for several decades, but the remains of branches ranging from short stubs at the top to complete systems including twigs at the bottom (fig. 2, D and E) clearly show that killing has been progressive.

Logs from killed portions of trunks are mostly cull because of pitch-soak and stain. Except in late stages of infection, however, damage is confined to low-volume and low-quality logs. In young-mature trees, loss may be largely offset by higher quality growth on the rest of the trunk.

Distinction between top-killing by comandra rust and that by other agents is important in timber management. Although dead tops are generally considered indicative of high-risk trees, this is not true of rust-killed tops unless the remaining crown is of poor vigor or killing has progressed so far that little crown remains. Many trees with rust-killed tops have better than average color, density, and needle length in the remaining crown, probably because the slowly shrinking crown is generously supplied by an even more slowly impaired root system. Such trees appear to be no more than ordinarily susceptible to attacks by beetles, root rots, and other enemies.

RECOMMENDATIONS

Sapling and small-pole stands. — Some damage to thinned stands must be expected in localities where rust-killed tops are common in mature trees or occasional cankers are seen in small trees. To hold damage to a minimum:

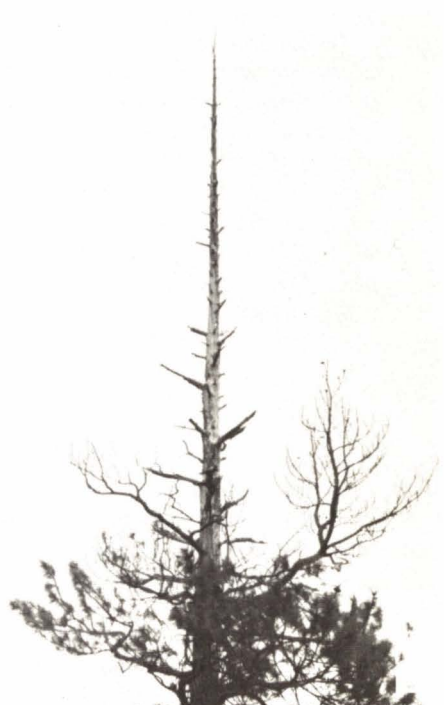
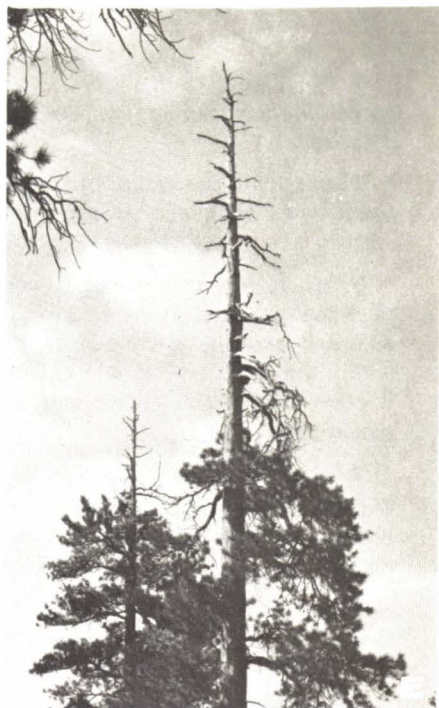


Figure 2. A, Branches killed where comandra rust has recently girdled the trunk (top of crown is fading slightly but is still dense); B, thin and faded top above girdled trunk; C, branches recently killed by downward growth of canker; D, E, and F, old killed tops, showing progressive deterioration of dead branches from top to bottom.



1. Familiarize thinning crews with symptoms of the disease. Experienced workers can reduce the number of infected trees that escape detection.

2. Eliminate suspected infections as well as definitely identified ones. Sacrifice a little quality, if necessary, to avoid leaving trees that may not survive.

3. Where the disease is very common, leave some extra stocking of trees that are small enough to remain suppressed if the crop trees survive and well enough distributed to replace crop trees that may be killed within the next few years by infections present at time of thinning. Or, if other tree species are present, consider the possible advantages of a mixed stand.

4. Use only local stock for planting. Experience with other rusts suggests that nonlocal stock may often be much more susceptible than local stock. There are, of course, many other reasons for preferring local stock.

Pruning for disease control is not economically practicable, but elimination of infections that have not yet reached the trunk is a minor benefit that may be credited against pruning costs.

Mature stands. — In its early stages, the disease is an immediate threat only if infection enters the trunk below midcrown; this is not very common even in young-mature trees and is rare in old growth. Intermediate and late stages (fig. 2, C, D, E, and F) are so obvious that no special measures are needed to insure removal of moribund trees. To minimize loss:

1. Cut all merchantable trees with young cankers at or below mid-crown (for example, fig. 1, E and G). The entire crown above the canker will soon be killed and the tree may not survive such drastic injury.

2. Cut trees with cankers above midcrown when position of the tree in the stand is such that death of the crown above the canker will put it at a serious disadvantage competitively. For example, the infected tree in figure 2A may be badly hurt by combined effects of top-killing and crowding.

3. Old-growth trees with crowns of good density and color should not be cut just because they have rust-killed tops, unless dieback at a rate of about one-half foot per year will dangerously shorten the crown before the next cut is made. For example, the tree at the left in figure 2E can reasonably be expected to survive through a 25-year cutting cycle even though it would lose 10 or 12 feet of crown; it might be cut for other reasons but is not an imminent mortality risk.

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